Leveraging GIS Tools and Data to Support the Water Sector

July 25, 2019

Justin Graham, GISP, AWAM
Applied Technologies Practice Leader

Agenda

GIS and the Water Sector

Advancements in Technology

GIS Applied

Steps Forward

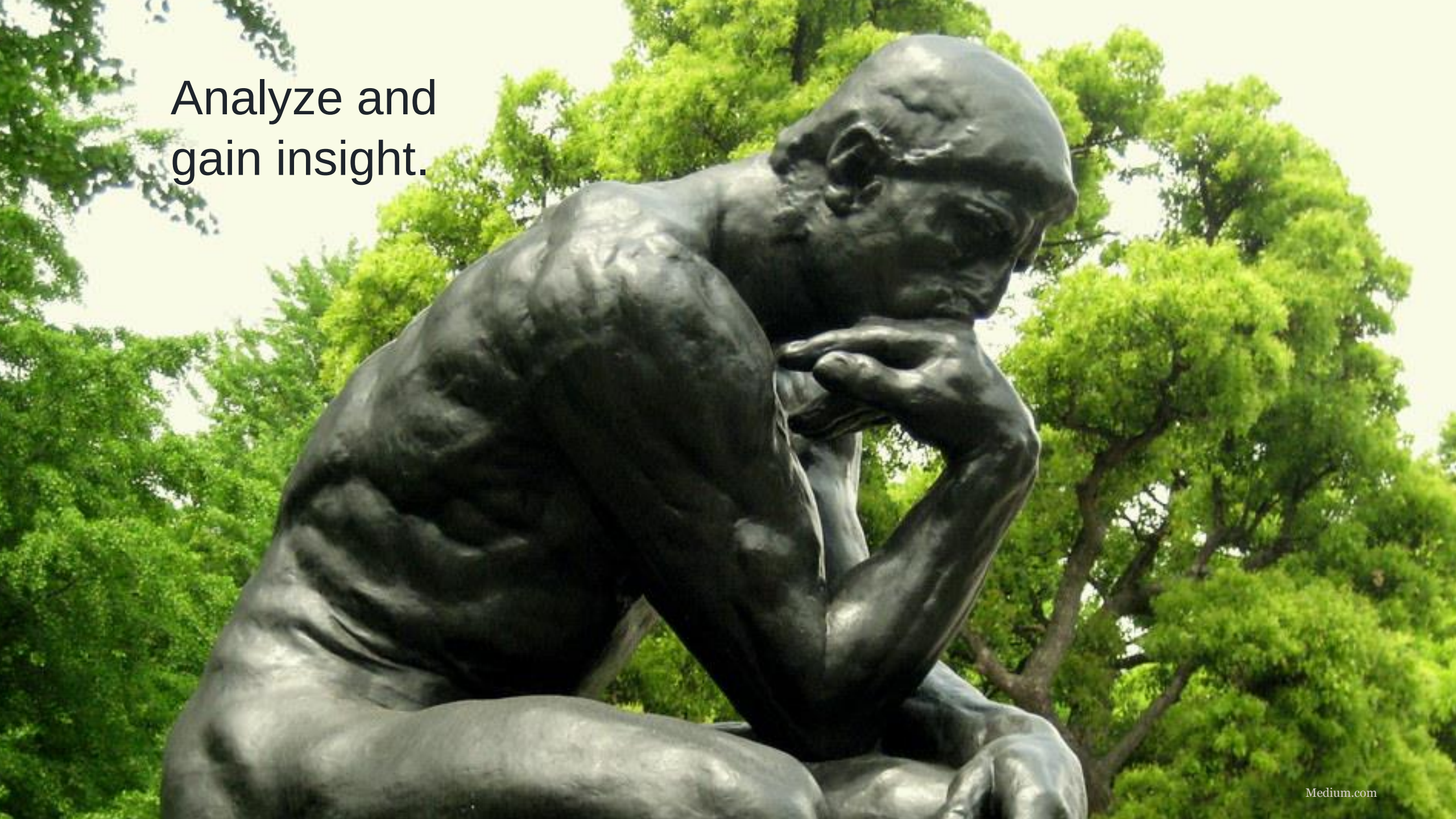
"GIS is a form of digital mapping technology. Kind of like Google Earth, but better." **Arnold Schwarzenegger**

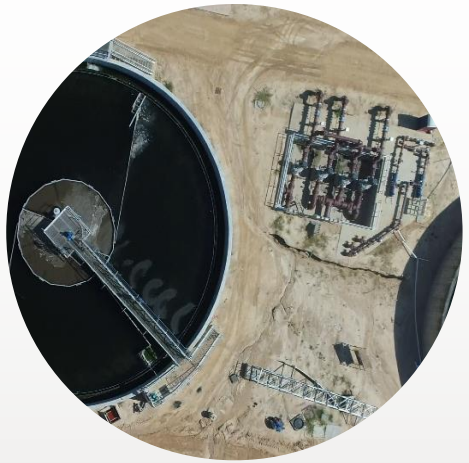
Reduce silos of information.

Where are your assets?

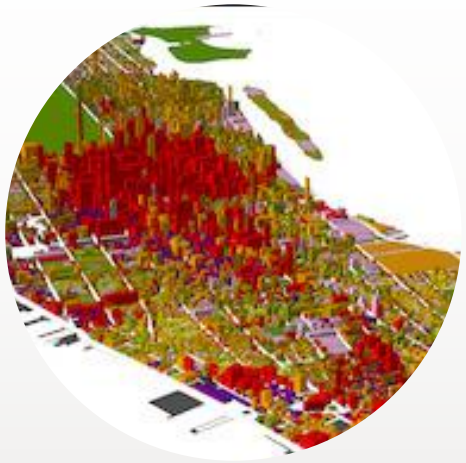
Engage and share with others.

Idwholesaler.com


Analyze and
gain insight.
Medium.com



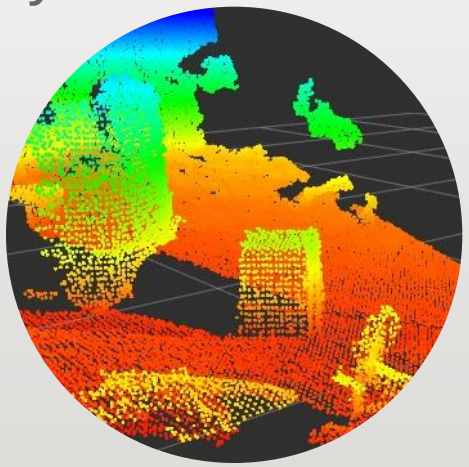
Imagery



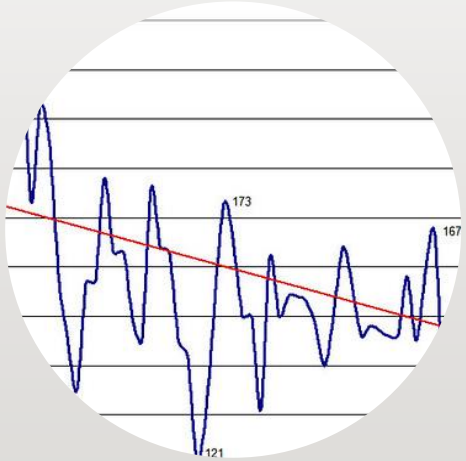
3D

Vector

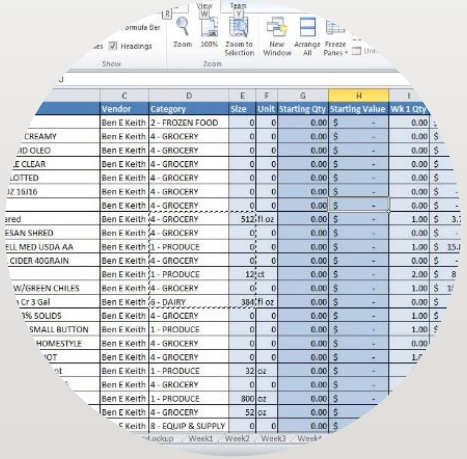
CAD/BIM



LiDAR

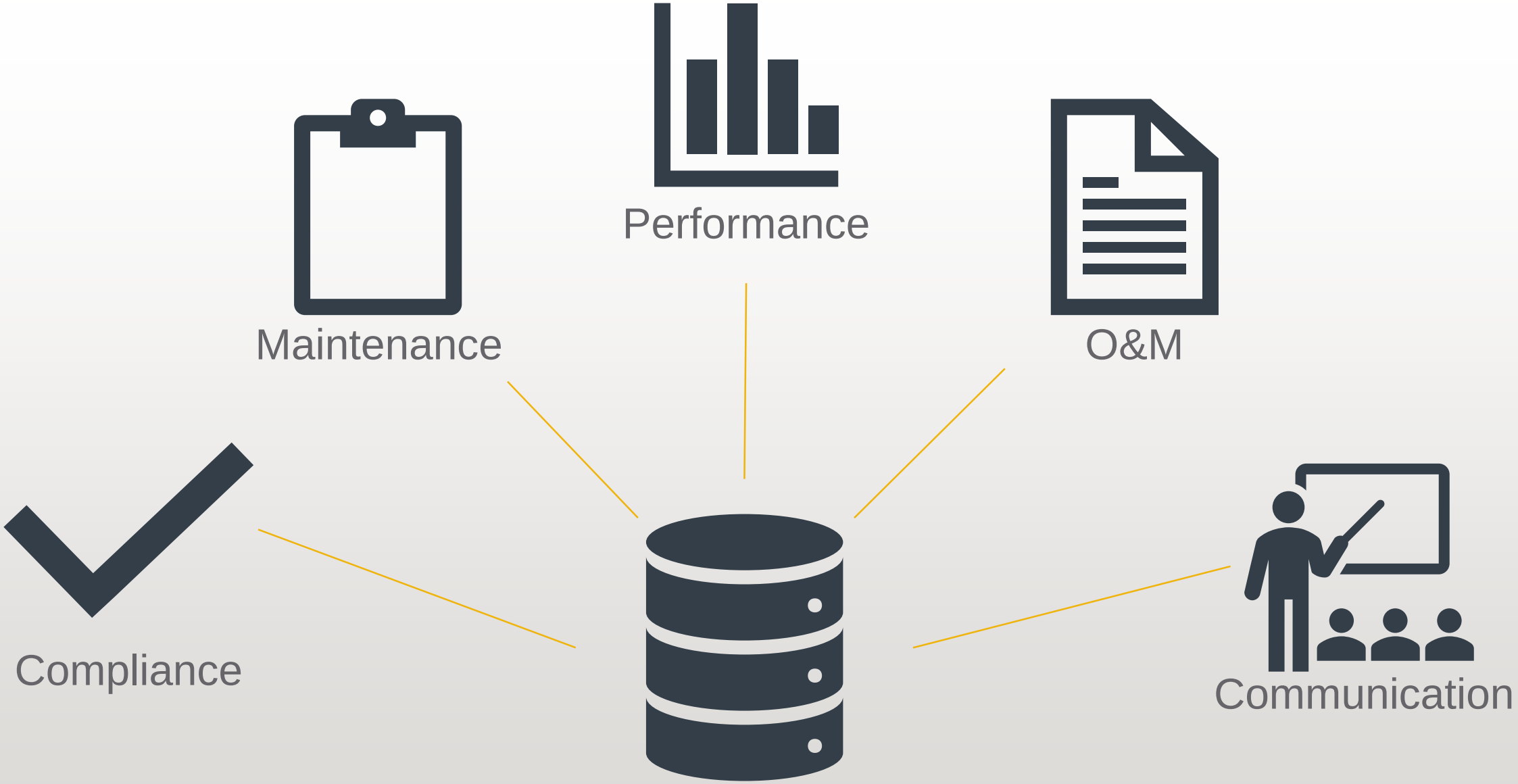


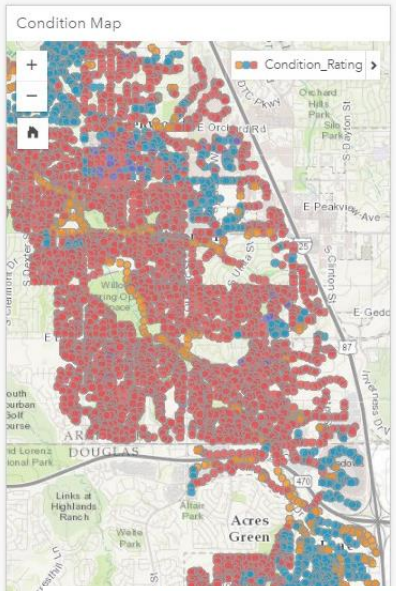
Real-Time

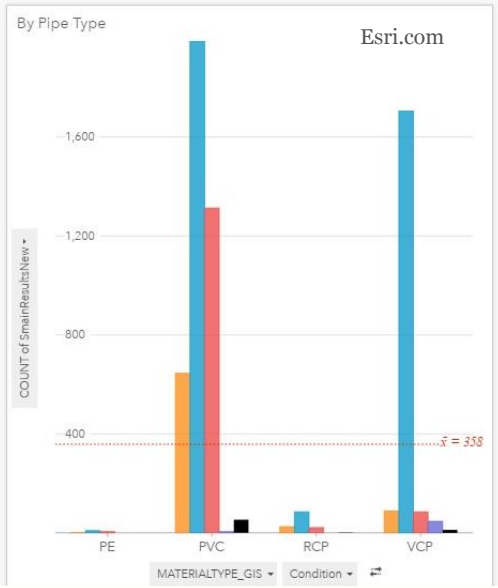


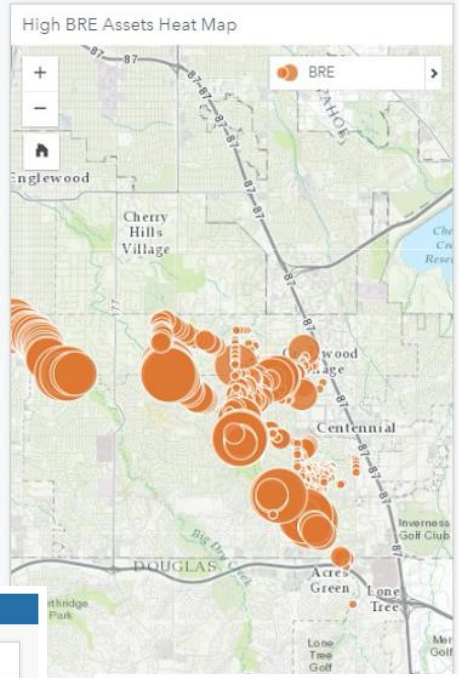
	Vendor	Category	Size	Unit	Starting Qty	Starting Value	Wk 1 Qty
CREAMY	Ben E Keith	2 - FROZEN FOOD	0	0	0.00	$ -	0.00
ID OLEO	Ben E Keith	4 - GROCERY	0	0	0.00	$ -	0.00
E CLEAR	Ben E Keith	4 - GROCERY	0	0	0.00	$ -	0.00
LOTTED	Ben E Keith	4 - GROCERY	0	0	0.00	$ -	0.00
Z 16/16	Ben E Keith	4 - GROCERY	0	0	0.00	$ -	0.00
	Ben E Keith	4 - GROCERY	0	0	0.00	$ -	0.00
ared	Ben E Keith	4 - GROCERY	5125	fl oz	0.00	$ -	1.00
ESAN SHRED	Ben E Keith	4 - GROCERY	0	0	0.00	$ -	0.00
ELL MED USDA AA	Ben E Keith	1 - PRODUCE	0	0	0.00	$ -	1.00
CIDER 40GRAIN	Ben E Keith	4 - GROCERY	0	0	0.00	$ -	0.00
	Ben E Keith	1 - PRODUCE	12	ct	0.00	$ -	2.00
W/GREEN CHILES	Ben E Keith	4 - GROCERY	0	0	0.00	$ -	1.00
Cr 3 Gal	Ben E Keith	6 - DAIRY	384	fl oz	0.00	$ -	0.00
% SOLIDS	Ben E Keith	4 - GROCERY	0	0	0.00	$ -	1.00
SMALL BUTTON	Ben E Keith	1 - PRODUCE	0	0	0.00	$ -	1.00
HOMESTYLE	Ben E Keith	4 - GROCERY	0	0	0.00	$ -	0.00
OT	Ben E Keith	4 - GROCERY	0	0	0.00	$ -	1.00
	Ben E Keith	1 - PRODUCE	32	oz	0.00	$ -	
	Ben E Keith	4 - GROCERY	0	0	0.00	$ -	
	Ben E Keith	1 - PRODUCE	800	oz	0.00	$ -	
	Ben E Keith	4 - GROCERY	52	oz	0.00	$ -	
	Keith	8 - EQUIP & SUPPLY	0	0	0.00	$ -	

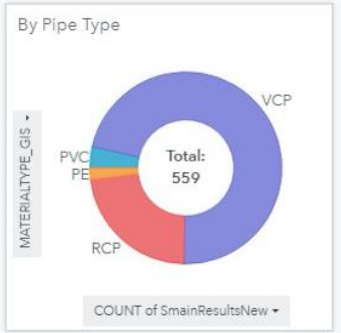
Tabular

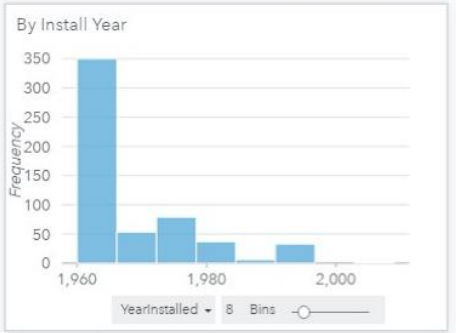

Performance
Maintenance
O&M
Compliance
Communication

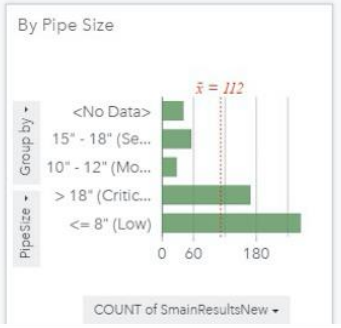

Condition Map
Condition_Rating
DOUGLAS
Acres Green

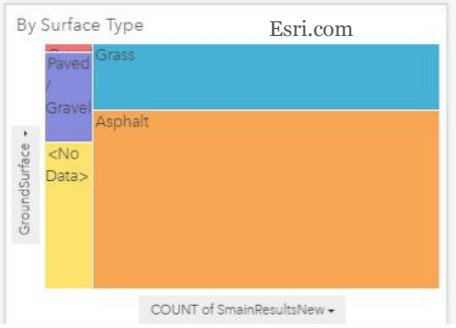

By Pipe Type
Esri.com
1,600
1,200
800
400
x̄ = 358
PE
PVC
RCP
VCP
COUNT of SmainResultsNew
MATERIALTYPE_GIS
Condition

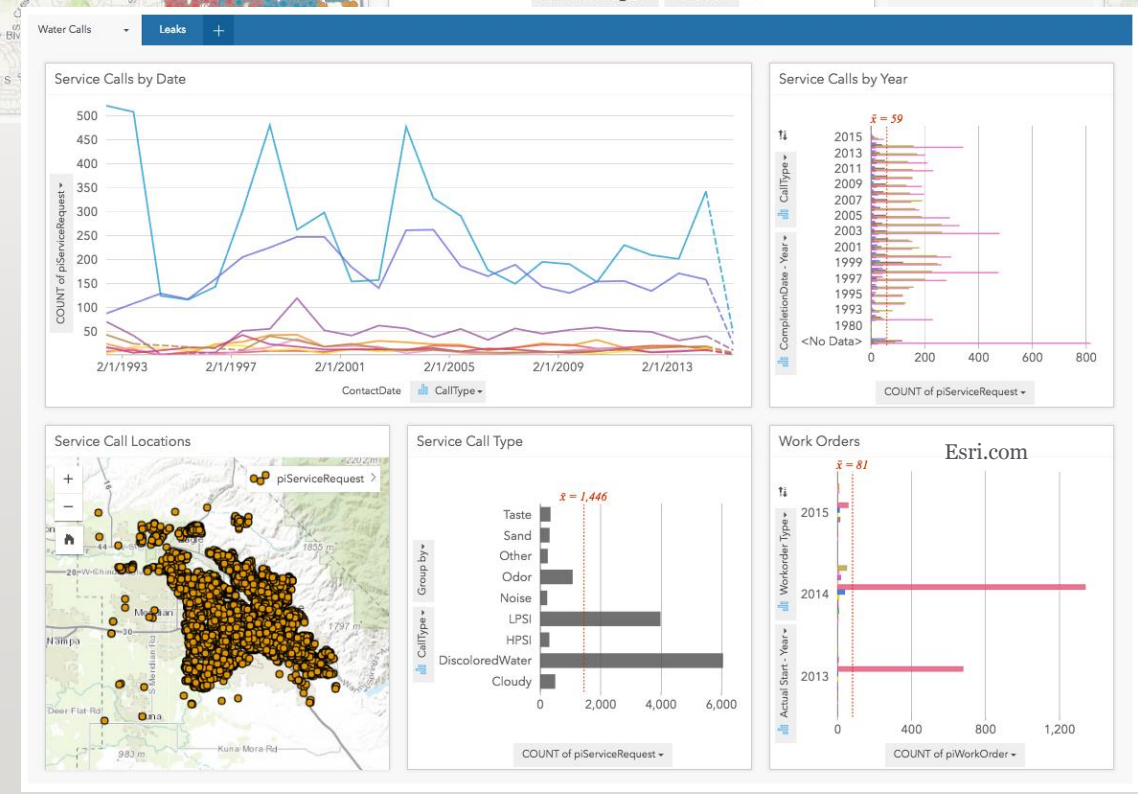

High BRE Assets Heat Map
BRE
Englewood
Cherry Hills Village
Centennial
DOUGLAS
Acres Green
Lone Tree
Inverness Golf Club

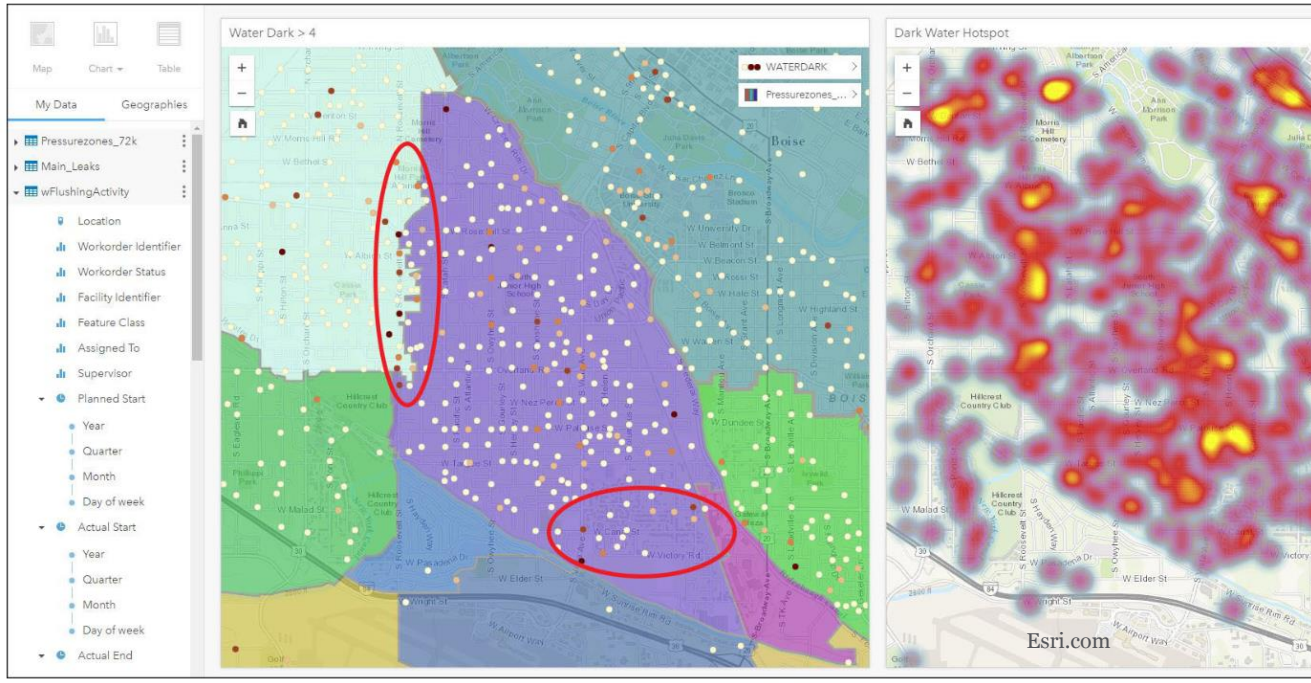

By Pipe Type
MATERIALTYPE_GIS
VCP
PVC
PE
RCP
Total:
559
COUNT of SmainResultsNew


By Install Year
Frequency
350
300
250
200
150
100
50
0
1,960
1,980
2,000
YearInstalled
8
Bins


By Pipe Size
Group by
PipeSize
x̄ = 112
<No Data>
15" - 18" (Se...
10" - 12" (Mo...
> 18" (Critic...
<= 8" (Low)
0
60
180
COUNT of SmainResultsNew


By Surface Type
Esri.com
GroundSurface
Paved
Gravel
<No Data>
Grass
Asphalt
COUNT of SmainResultsNew


Water Calls
Leaks
Service Calls by Date
COUNT of piServiceRequest
2/1/1993
2/1/1997
2/1/2001
2/1/2005
2/1/2009
2/1/2013
ContactDate
CallType
Service Calls by Year
x̄ = 59
2015
2013
2011
2009
2007
2005
2003
2001
1999
1997
1995
1993
1980
<No Data>
CompletionDate - Year
COUNT of piServiceRequest
Service Call Locations
piServiceRequest
Service Call Type
x̄ = 1,446
Taste
Sand
Other
Odor
Noise
LPSI
HPSI
DiscoloredWater
Cloudy
Group by
CallType
COUNT of piServiceRequest
Work Orders
Esri.com
x̄ = 81
2015
2014
2013
Workorder Type
Actual Start - Year
COUNT of piWorkOrder


Map
Chart
Table
My Data
Geographies
Pressurezones_72k
Main_Leaks
wFlushingActivity
Location
Workorder Identifier
Workorder Status
Facility Identifier
Feature Class
Assigned To
Supervisor
Planned Start
Year
Quarter
Month
Day of week
Actual Start
Actual End
Water Dark > 4
WATERDARK
Pressurezones_...
Boise
Dark Water Hotspot
Esri.com

MOM
NCTS
CWA
IMS
SSO
EPA
SSES
FSE
CAP
WWTP
IRP
AOC
CCTV
CSSAP
NPDES
SORP
POTW
CMOM
ADEM

Advancements in Technology

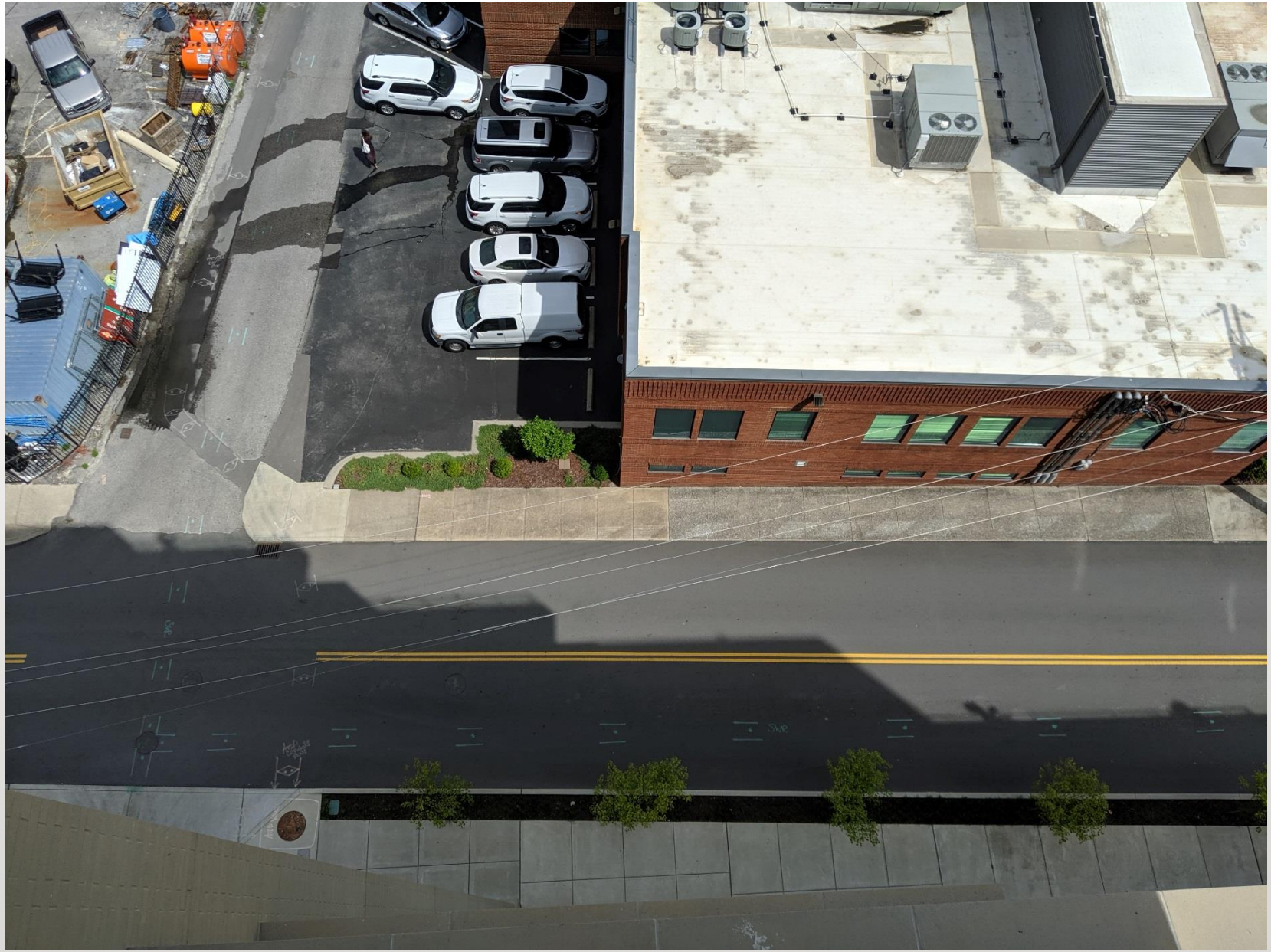
Inventory

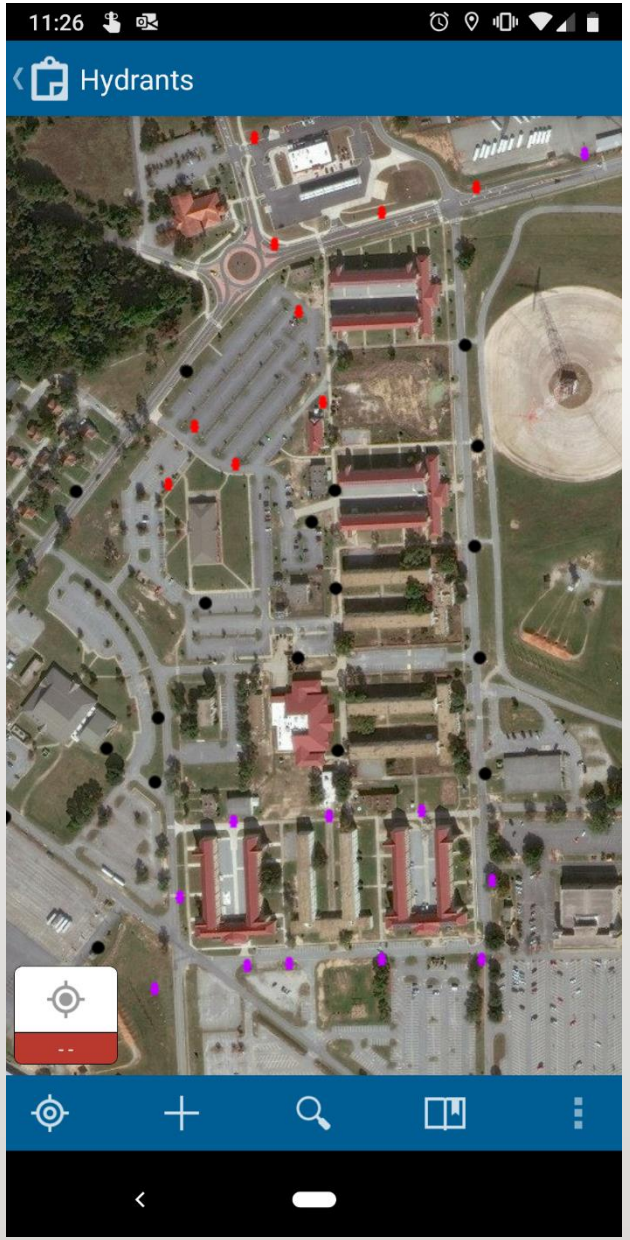
Assess

Store / Analyze

Share / Integrate

Inventory





Assess

12:21

Lift Station A...

Valve Vault Dimensions (ft)

Valves on top of wet well

Is there leaking at the pipe, joints, or fittings?

YES | NO | N/A

Is the paint in good condition?

YES | NO | N/A

Is there evidence of hydrogen sulfide?

YES | NO | N/A

Is there visual evidence of spalling, cracks, or seepage in concrete?

YES | NO | N/A

Are the shut-off valves located outside of the valve vault?

YES | NO | N/A

App Store 11:56 AM Thu Jul 11

6%

Maps

Flow Monitor Investigation

SewerPipes: Gravity Main

469.6 ft

180 mi

Junction Node 1

-

Junction Node 2

-

Pipe Type

Gravity Main

Diameter

36 "

Material

DIP

Length

-

Exterior Coating

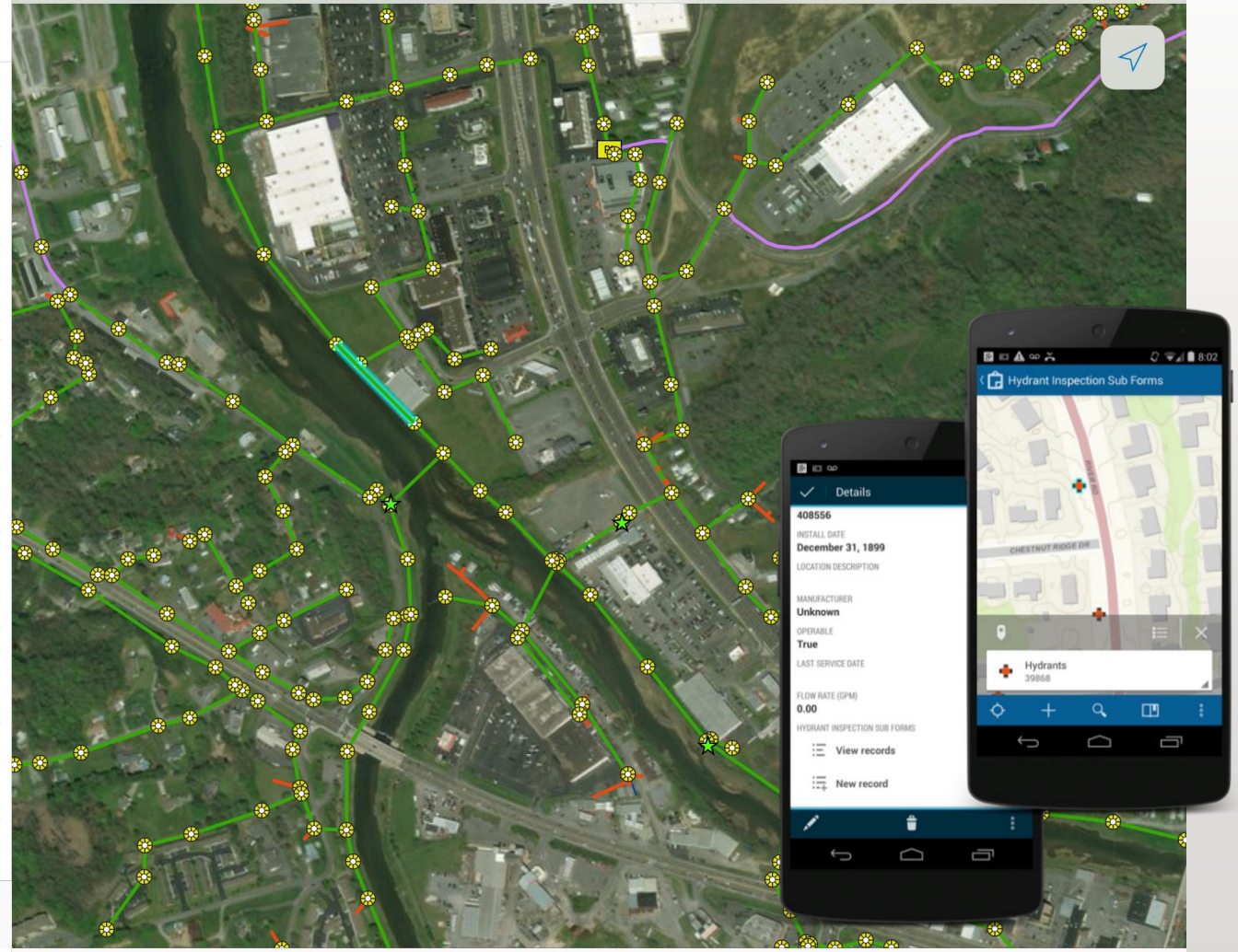
-

Fluid Type

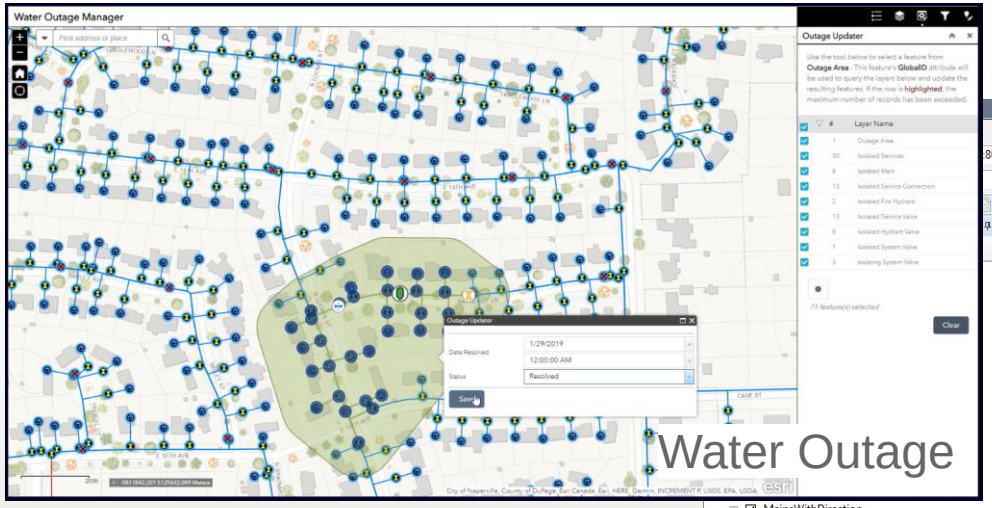
Waste Water

Life Cycle

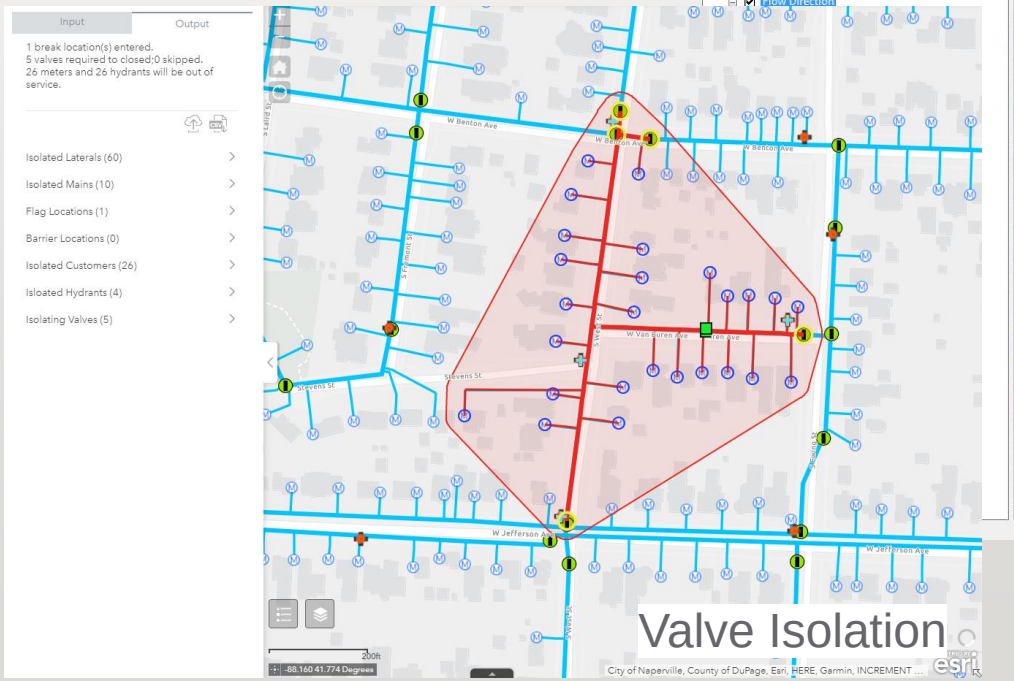
GPS accuracy 213.3 ft · required 30 ft

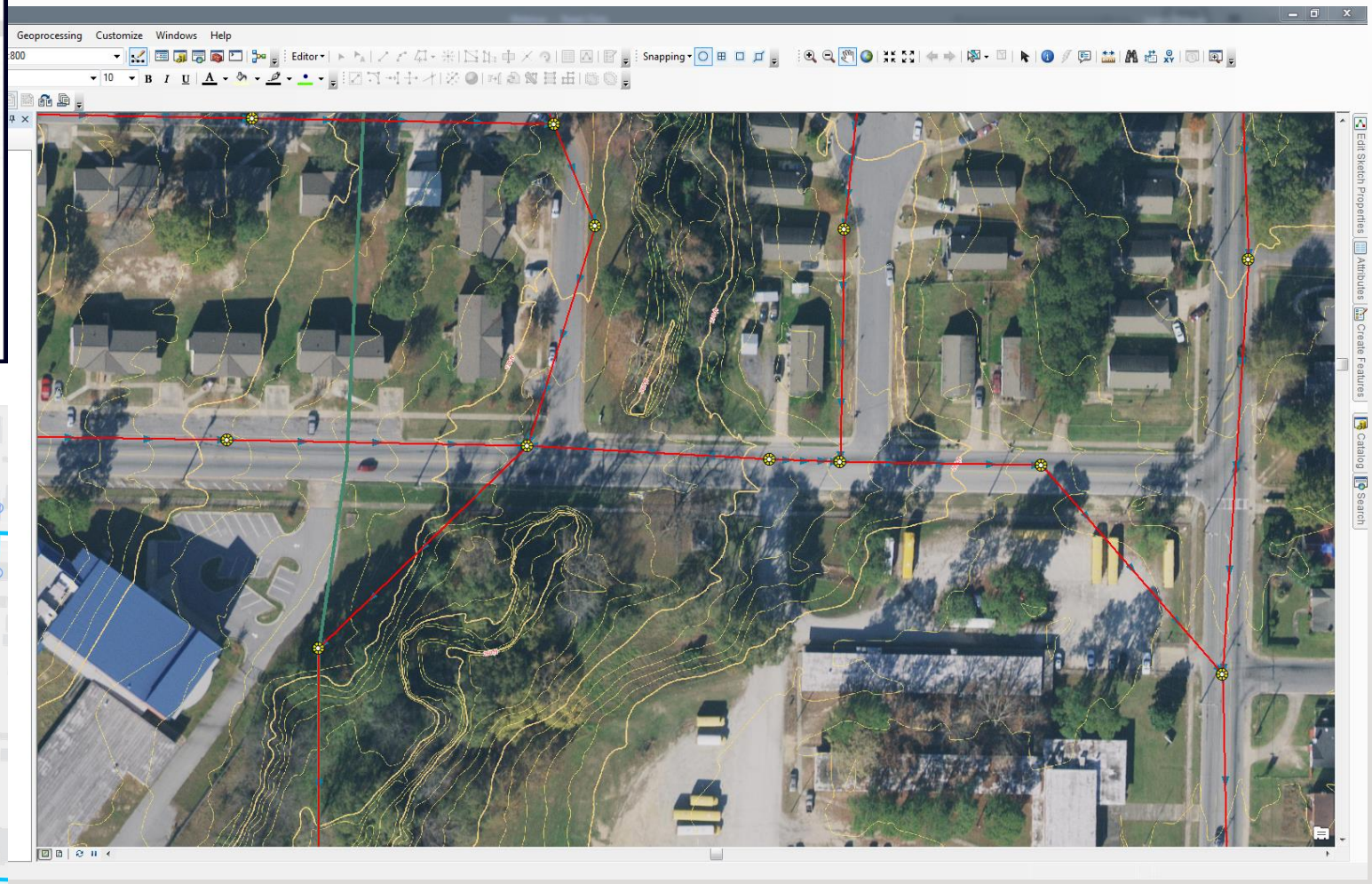


Store / Analyze

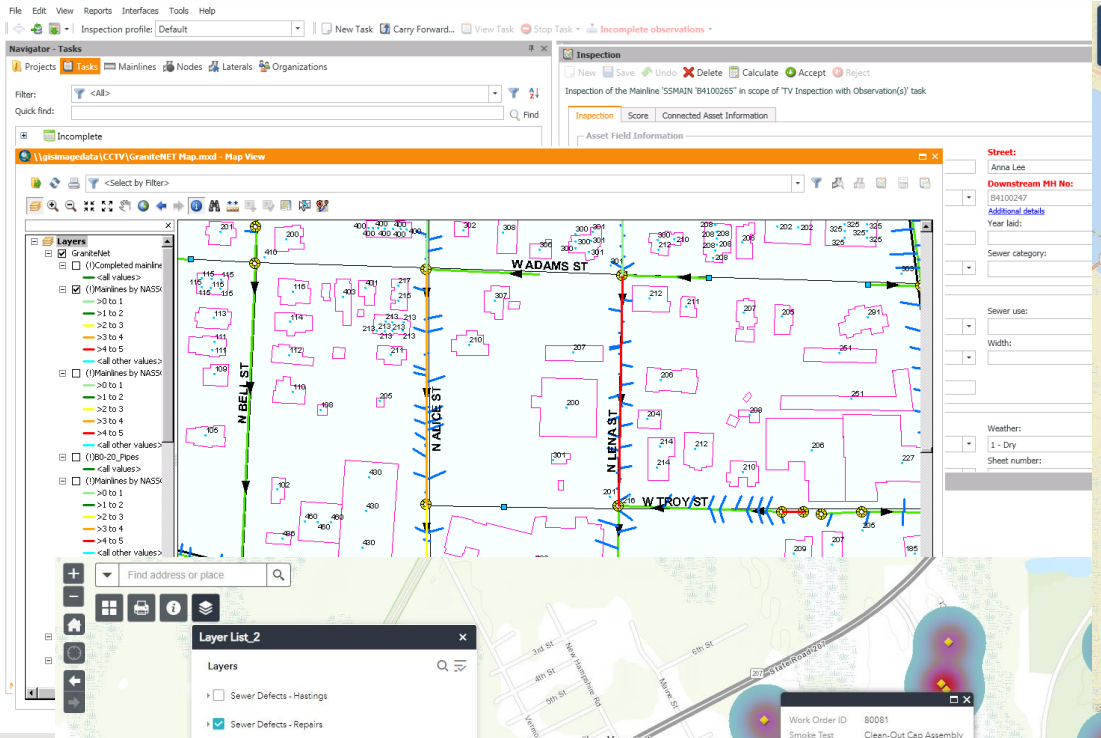


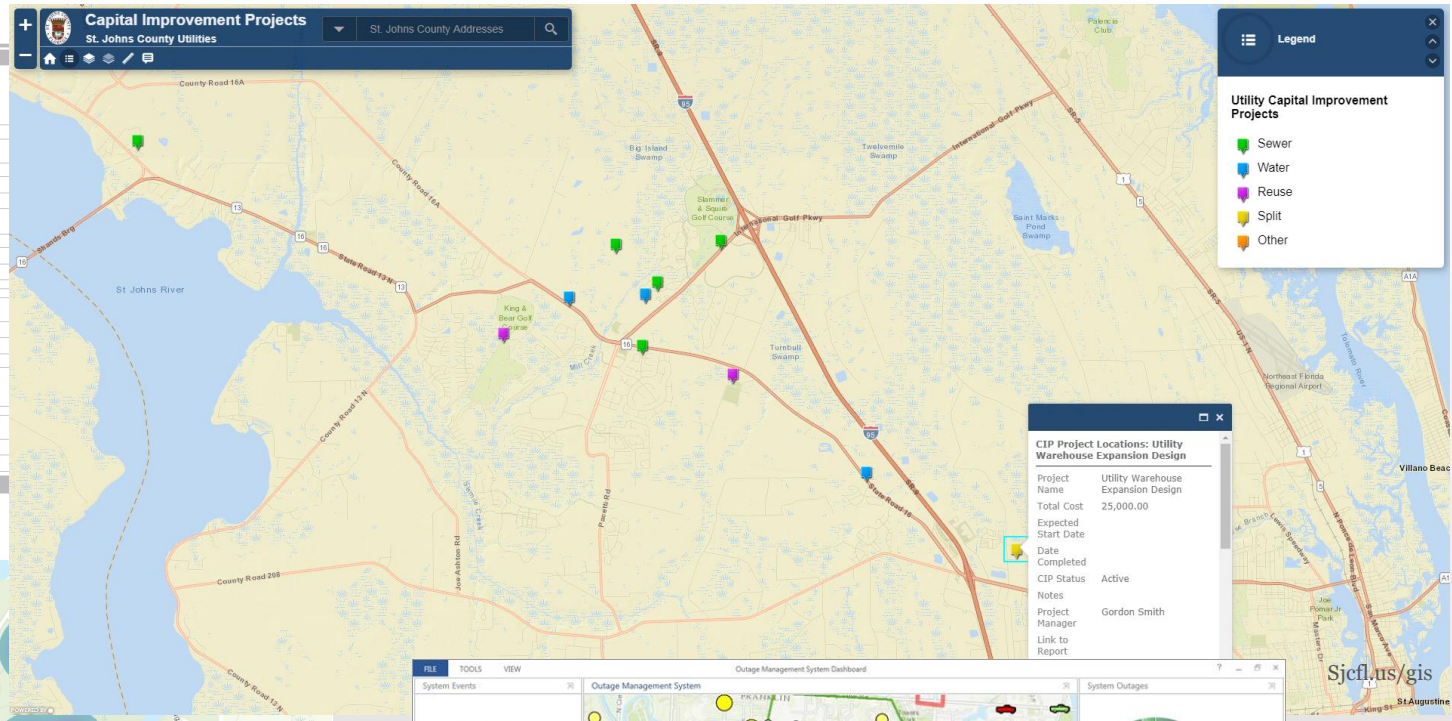
Esri.com

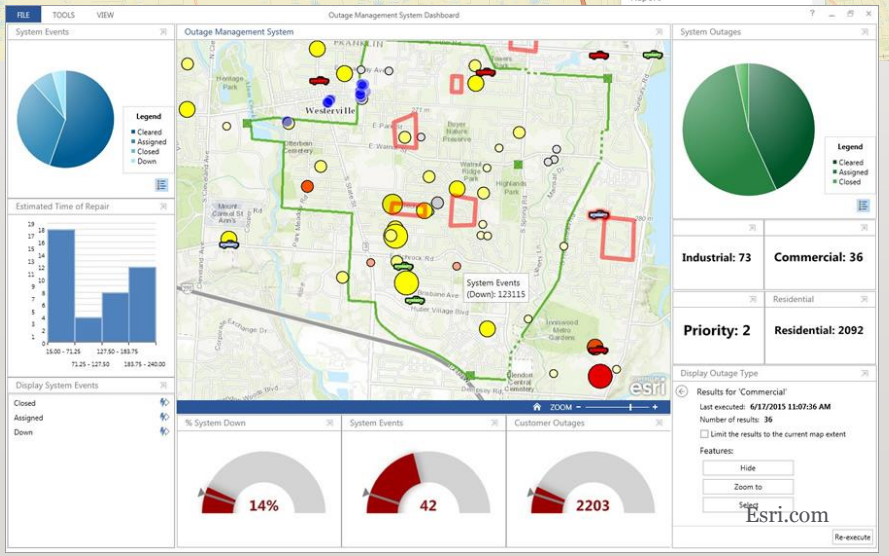




Share / Integrate







GIS as the foundation of other systems

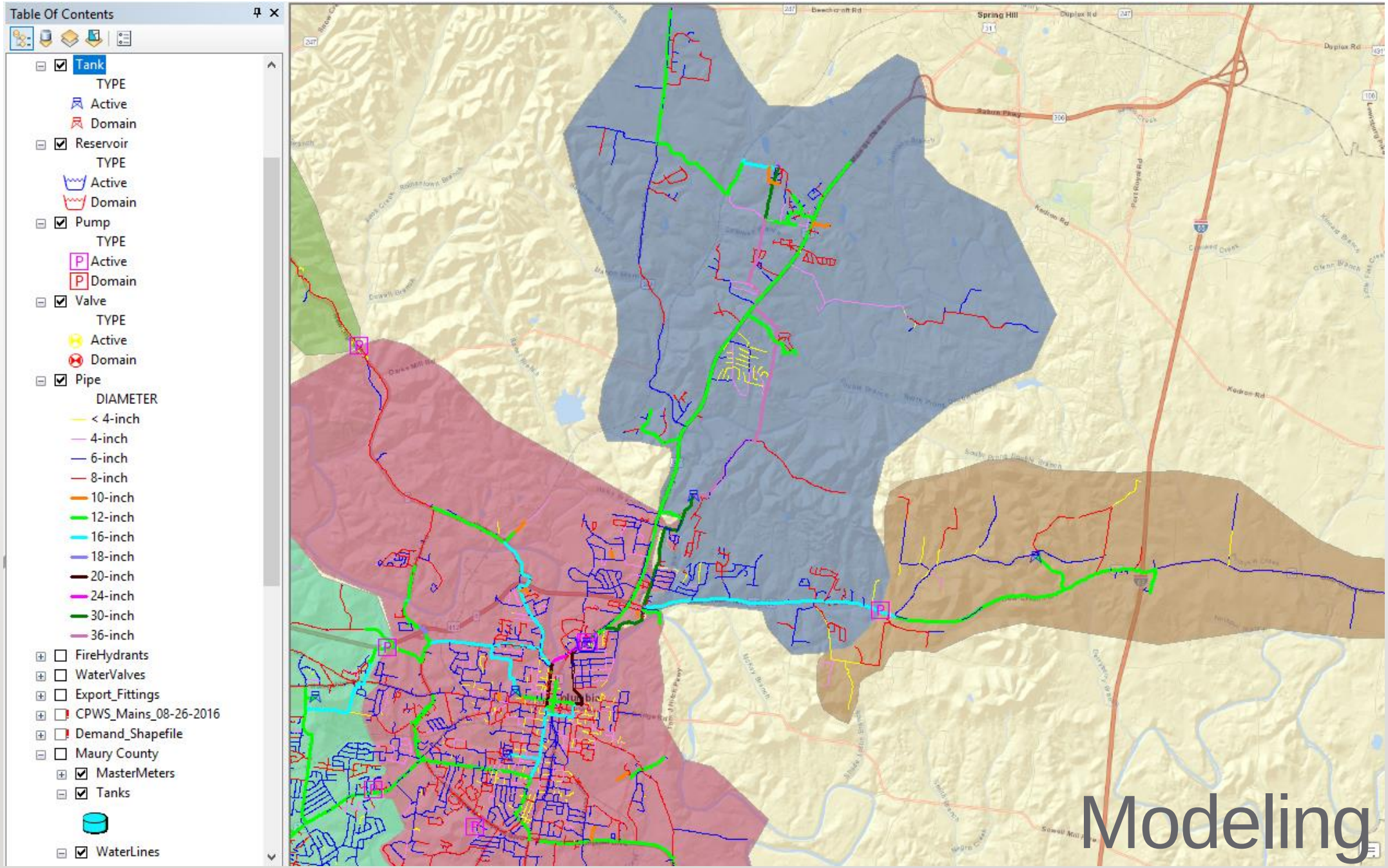
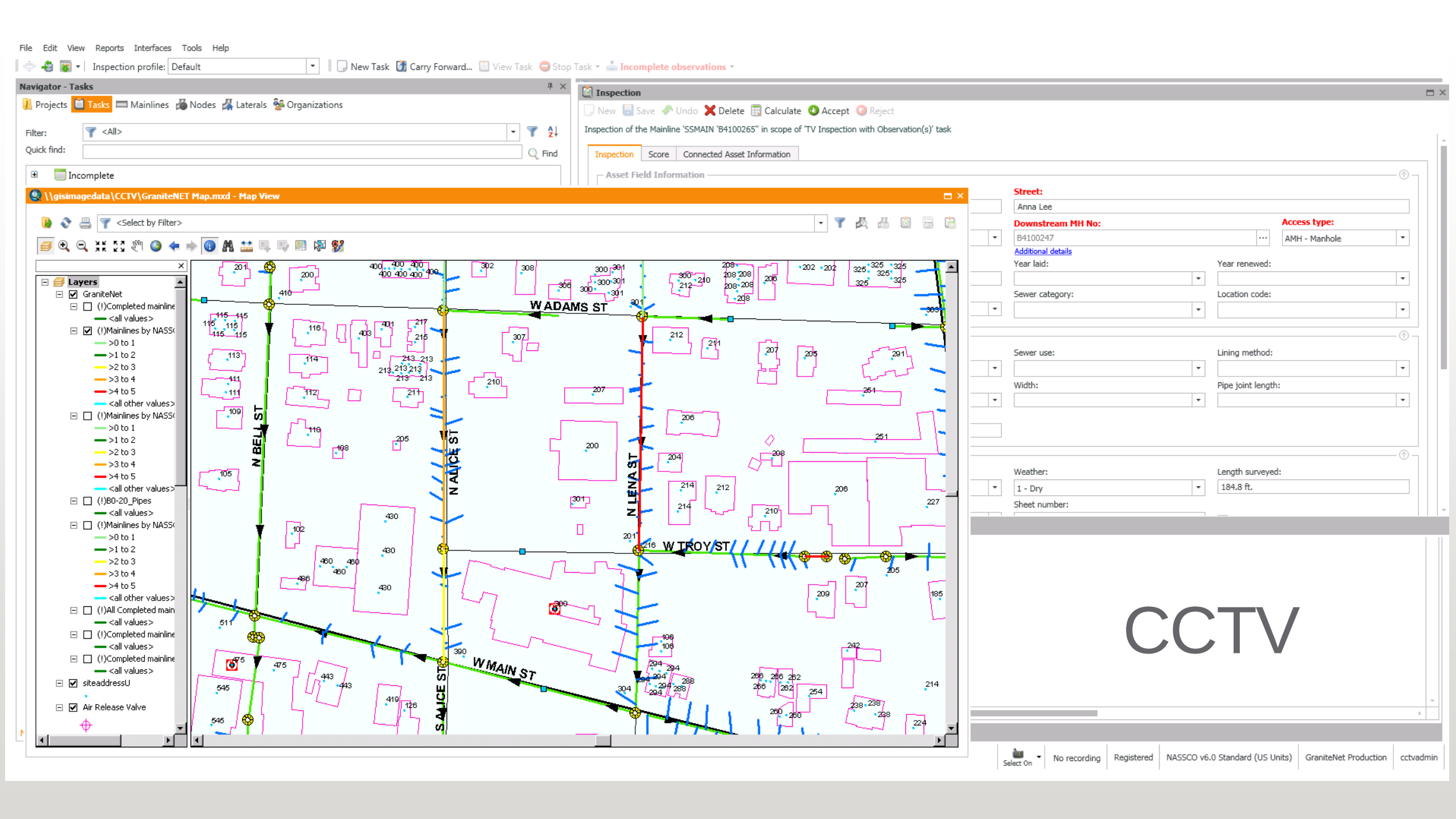
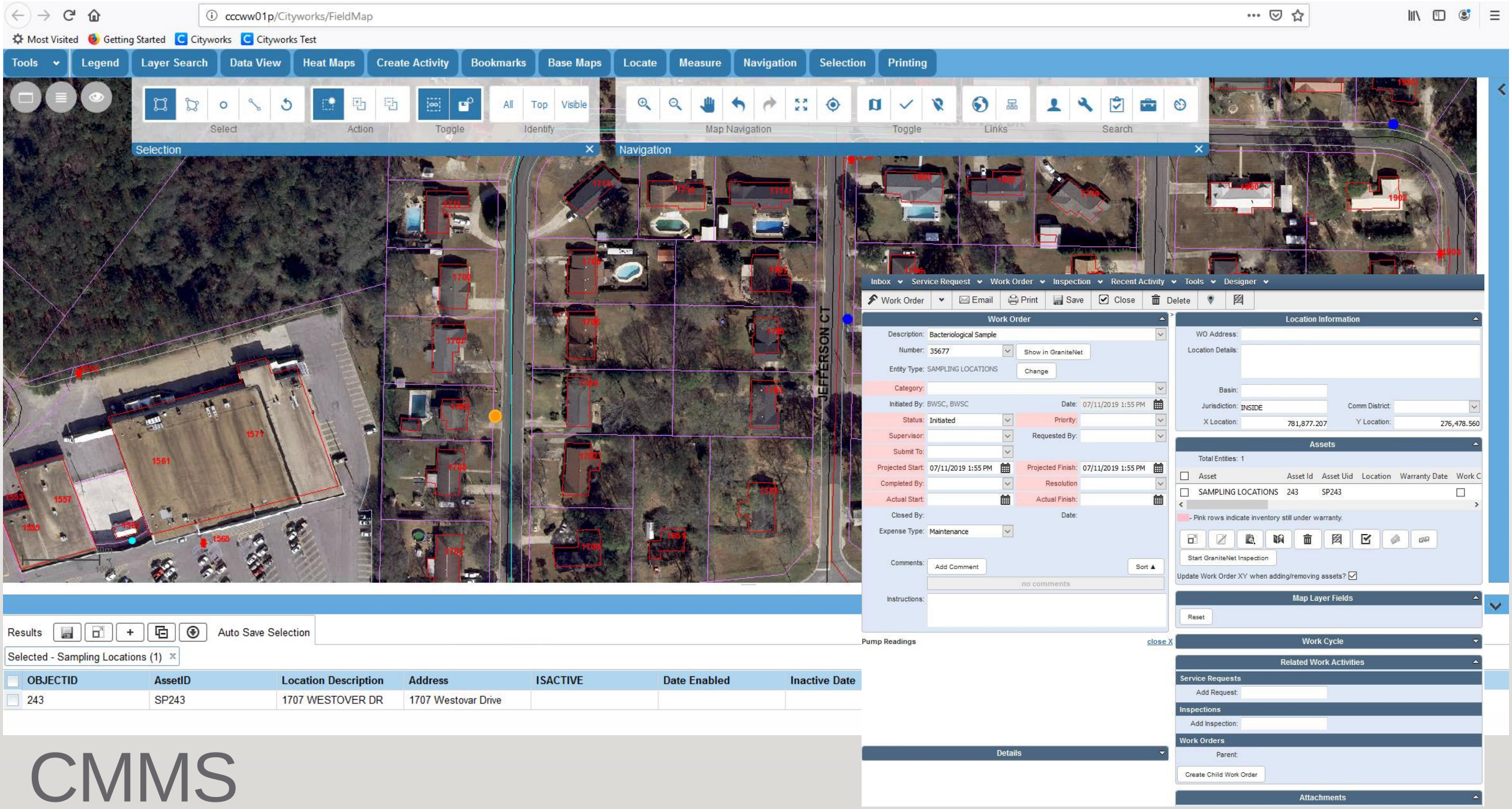


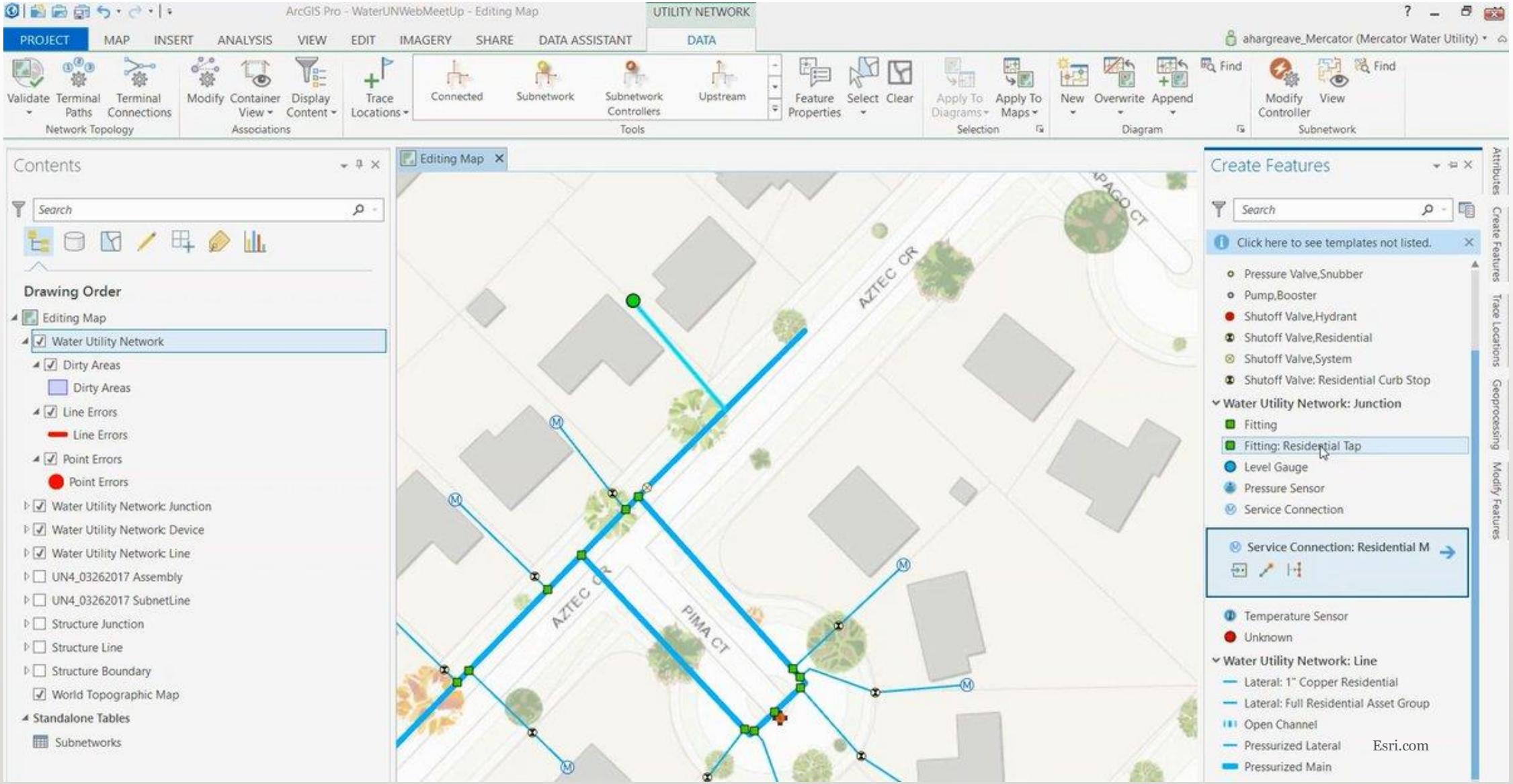
Table Of Contents
Tank
TYPE
Active
Domain
Reservoir
TYPE
Active
Domain
Pump
TYPE
Active
Domain
Valve
TYPE
Active
Domain
Pipe
DIAMETER
< 4-inch
4-inch
6-inch
8-inch
10-inch
12-inch
16-inch
18-inch
20-inch
24-inch
30-inch
36-inch
FireHydrants
WaterValves
Export_Fittings
CPWS_Mains_08-26-2016
Demand_Shapefile
Maury County
MasterMeters
Tanks
WaterLines
Modeling


File Edit View Reports Interfaces Tools Help
Inspection profile: Default
New Task Carry Forward... View Task Stop Task Incomplete observations
Navigator - Tasks
Projects Tasks Mainlines Nodes Laterals Organizations
Filter: <All>
Quick find: Find
Incomplete
\\gisimagedata\CCTV\GraniteNET Map.mxd - Map View
<Select by Filter>
Layers
GraniteNet
(!)Completed mainline
<all values>
(!)Mainlines by NASS
>0 to 1
>1 to 2
>2 to 3
>3 to 4
>4 to 5
<all other values>
(!)Mainlines by NASS
>0 to 1
>1 to 2
>2 to 3
>3 to 4
>4 to 5
<all other values>
(!)B0-20_Pipes
<all values>
(!)Mainlines by NASS
>0 to 1
>1 to 2
>2 to 3
>3 to 4
>4 to 5
<all other values>
(!)All Completed main
<all values>
(!)Completed mainline
<all values>
(!)Completed mainline
<all values>
siteaddressU
Air Release Valve
W ADAMS ST
N BELL ST
N ALICE ST
N LENA ST
W TROY ST
W MAIN ST
S ALICE ST
Inspection
New Save Undo Delete Calculate Accept Reject
Inspection of the Mainline 'SSMAIN 'B4100265" in scope of 'TV Inspection with Observation(s)' task
Inspection Score Connected Asset Information
Asset Field Information
Street:
Anna Lee
Downstream MH No:
B4100247
Access type:
AMH - Manhole
Additional details
Year laid:
Year renewed:
Sewer category:
Location code:
Sewer use:
Lining method:
Width:
Pipe joint length:
Weather:
1 - Dry
Length surveyed:
184.8 ft.
Sheet number:
CCTV
Select On
No recording
Registered
NASSCO v6.0 Standard (US Units)
GraniteNet Production
cctvadmin


cccww01p/Cityworks/FieldMap
Most Visited
Getting Started
Cityworks
Cityworks Test
Tools
Legend
Layer Search
Data View
Heat Maps
Create Activity
Bookmarks
Base Maps
Locate
Measure
Navigation
Selection
Printing
Select
Action
Toggle
All
Top
Visible
Identify
Map Navigation
Toggle
Links
Search
Selection
Navigation
JEFFERSON CT
Inbox
Service Request
Work Order
Inspection
Recent Activity
Tools
Designer
Work Order
Email
Print
Save
Close
Delete
Work Order
Description: Bacteriological Sample
Number: 35677
Show in GraniteNet
Entity Type: SAMPLING LOCATIONS
Change
Category:
Initiated By: BWSC, BWSC
Date: 07/11/2019 1:55 PM
Status: Initiated
Priority:
Supervisor:
Requested By:
Submit To:
Projected Start: 07/11/2019 1:55 PM
Projected Finish: 07/11/2019 1:55 PM
Completed By:
Resolution
Actual Start:
Actual Finish:
Closed By:
Date:
Expense Type: Maintenance
Comments:
Add Comment
Sort
no comments
Instructions:
Location Information
WO Address:
Location Details:
Basin:
Jurisdiction: INSIDE
Comm District:
X Location: 781,877.207
Y Location: 276,478.560
Assets
Total Entities: 1
Asset
Asset Id
Asset Uid
Location
Warranty Date
Work C
SAMPLING LOCATIONS
243
SP243
- Pink rows indicate inventory still under warranty.
Start GraniteNet Inspection
Update Work Order XY when adding/removing assets?
Map Layer Fields
Reset
Work Cycle
Related Work Activities
Service Requests
Add Request:
Inspections
Add Inspection:
Work Orders
Parent:
Create Child Work Order
Attachments
Pump Readings
close X
Details
Results
Auto Save Selection
Selected - Sampling Locations (1)
OBJECTID
AssetID
Location Description
Address
ISACTIVE
Date Enabled
Inactive Date
243
SP243
1707 WESTOVER DR
1707 Westovar Drive

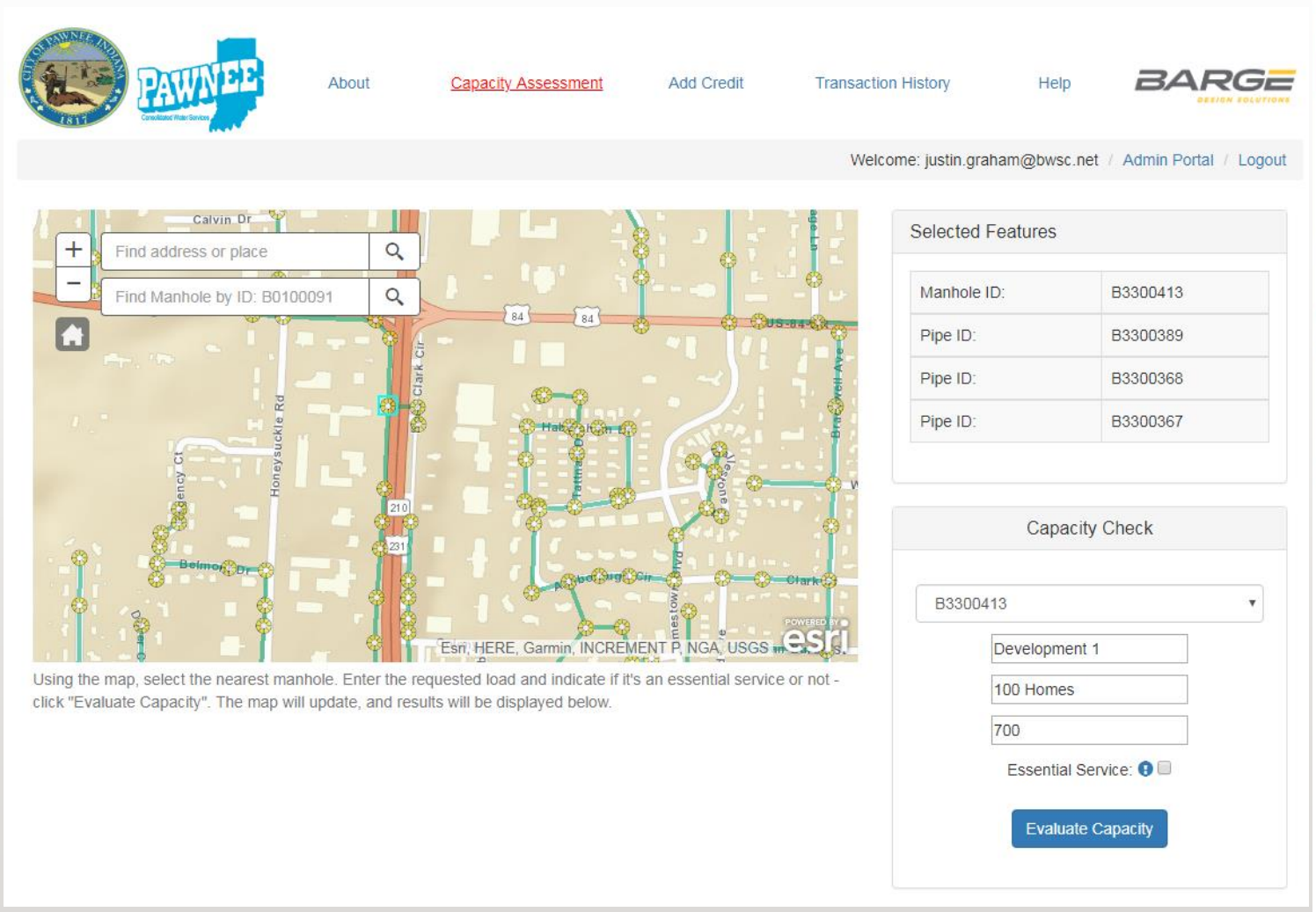
CMMS

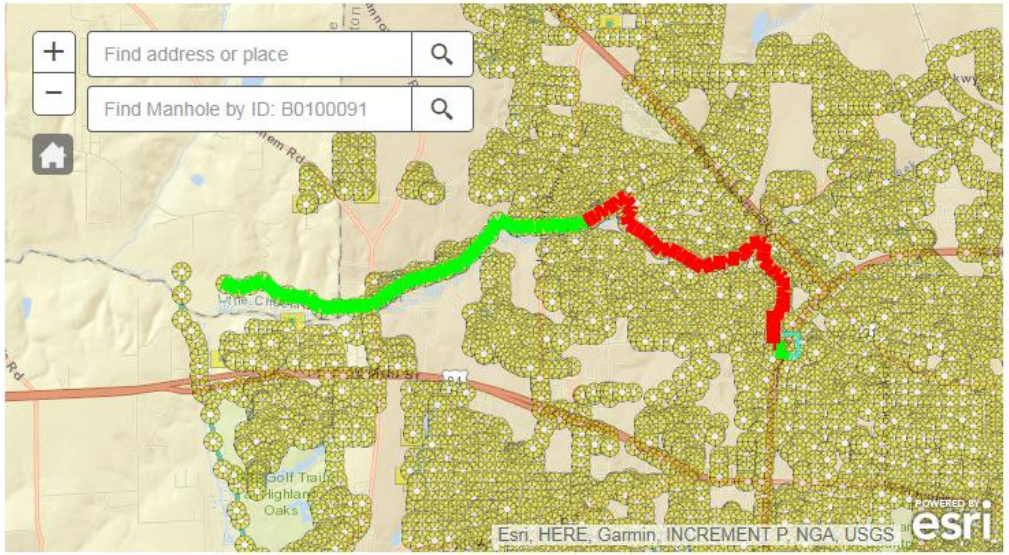
Desktop



Esri.com

Custom Web





Feature Results

Asset	Asset Type	Diameter (inches)	Current Capacity (GPD)	Results
B4500488	pipe	8	255495	PASS
B4500271	pipe	8	662043	PASS
B4500375	pipe	8	285571	PASS
LCpipe-61	pipe	8	286201	PASS
LCpipe-62	pipe	8	0	FAIL
B4500365	pipe	8	0	FAIL
B4500263	pipe	8	0	FAIL
B4500267	pipe	8	-10954	FAIL
B4500266	pipe	8	0	FAIL
B4500264	pipe	8	0	FAIL
B4500265	pipe	8	-23234	FAIL
B4500369	pipe	8	-165016	FAIL
B4500415	pipe	8	-290416	FAIL

Asset Management

Template Setup | Treatment | Service Criteria | Degradation Profile | Treatment Filter | Service Index | Backlog Allocation | Esri ArcGIS Integration

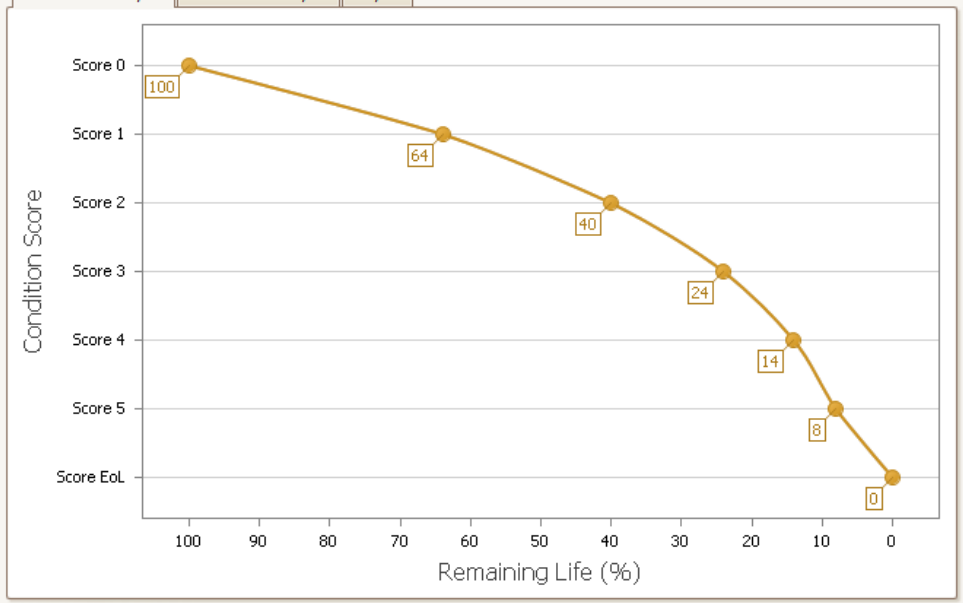
Treatments

Hie...	Treatment Name	Description	Grouping
1	Pipe Bursting	If not many service connections, up to 18" and AC...	Renewal
2	Clean and Line	For unlined CI pipes 8" and greater	Renewal
3	Small Line Replacement	Replace 4" and less with 8"	New
4	Velocity Issues	Pipe that has velocity issues from model	New
5	Pressure Issues	Pipe that has pressure issues from model	New
6	Replace	Replace pipe	New
7	Work Order History	Pipe that has 3 or more work orders	New

Unit Cost Variations

Variation Name
6" and less
8"-12"
14"-18"
20"-24"
26"-36"
38"-48"

Condition Score / RL | Condition Score / SP | SP / RL



Band : Required, Optional, Extra, Service, Treatment Filter, Service Index

Show Spider Chart | Show Pie Chart | Reset Dock

Required		Optional												
Unique Asset ID	Network Measure	Life Cycle Variation	Unit Cost Variation											
A7228	10.0198328704	CI	6" and less											
A7226	13.9885751469	DI	6" and less											
A6853	11.9732105292	DI	6" and less	DE HAVILLAND CT	High Service	2					UNK	DI	4" and less	2 or less
A6854	49.060082957	DI	6" and less	DE HAVILLAND CT	High Service	2					UNK	DI	4" and less	2 or less
A6855	41.6821038021	DI	6" and less	DE HAVILLAND CT	High Service	2					UNK	DI	4" and less	2 or less
A6856	177.488916625	DI	6" and less	DE HAVILLAND CT	High Service	2					UNK	DI	4" and less	2 or less
A0013	152.796129845	DI	26"-36"	CUSTER RD	Main P						UNK	DI	26"-36"	2 or less
A0014	32.907556315	DI	26"-36"	CUSTER RD	Main P						UNK	DI	26"-36"	2 or less
E0306	49.2845101798	DI	8"-12"	CUSTER RD	Main P						UNK	DI	8"-12"	2 or less
E0307	1.89855339005	DI	8"-12"	CUSTER RD	Main P						UNK	DI	8"-12"	2 or less
A0024	2.65511233585	DI	8"-12"	CUSTER RD	Main P						UNK	DI	8"-12"	2 or less
A0025	118.375816923	DI	8"-12"	CUSTER RD	Main P						UNK	DI	8"-12"	2 or less
A0026	1.94372906179	DI	8"-12"	CUSTER RD	Main P						UNK	DI	8"-12"	2 or less
A0027	80.6947991562	DI	8"-12"	CUSTER RD	Main P						UNK	DI	8"-12"	2 or less
A0028	126.50541265	DI	8"-12"	CUSTER RD	Main P						UNK	DI	8"-12"	2 or less
A0029	32.263585851	DI	8"-12"	CUSTER RD	Main P						UNK	DI	8"-12"	2 or less
A0030	139.61612084	DI	8"-12"	CUSTER RD	Main P						UNK	DI	8"-12"	2 or less
A0031	121.633724034	DI	8"-12"	CUSTER RD	Main P						UNK	DI	8"-12"	2 or less
A0032	2.39822375137	DI	8"-12"	CUSTER RD	Main P						UNK	DI	8"-12"	2 or less
A0033	2.14066970838	DI	8"-12"	CUSTER RD	Main P						UNK	DI	8"-12"	2 or less
A0034	2.80840086591	DI	8"-12"	CUSTER RD	Main P						UNK	DI	8"-12"	2 or less
A0035	1.87680107665	DI	8"-12"	CUSTER RD	Main P						UNK	DI	8"-12"	2 or less
A0036	126.438489514	DI	8"-12"	CUSTER RD	Main P						UNK	DI	8"-12"	2 or less
A0037	11.0298855374	DI	8"-12"	CUSTER RD	Main P						UNK	DI	8"-12"	2 or less
A0046	86.0982565571	DI	8"-12"	CUSTER RD	Main P						UNK	DI	8"-12"	2 or less
A0053	232.696257832	DI	8"-12"	CUSTER RD	Main P						UNK	DI	8"-12"	2 or less
A0058	317.096893918	DI	8"-12"	CUSTER RD	Main P						UNK	DI	8"-12"	2 or less
A0060	2.09289688692	DI	8"-12"	CUSTER RD	Main P						UNK	DI	8"-12"	2 or less
A0063	1.71527018231	DI	8"-12"	CUSTER RD	Main Post	2					UNK	DI	8"-12"	2 or less
A0074	5.00722699486	DI	8"-12"	CUSTER RD	Main Post	2					UNK	DI	8"-12"	2 or less
FWPM-A0078	118.479509403	DI	8"-12"	CUSTER RD	Main Post	2					UNK	DI	8"-12"	2 or less
FWPM-A0089	17.031700646	DI	8"-12"	CUSTER RD	Main Post	2					UNK	DI	8"-12"	2 or less

Record 1 of 38058

Model Setup | Treatment Criteria | Treatment Effect | Life Cycle

Treatments

Treatment Name
Pipe Bursting
Clean and Line
Small Line Replacement
Velocity Issues
Pressure Issues
Replace
Work Order History

Print

Situations

Situation Name
5 and 6, 8" to 18", AC/CI/DI, Few Ser...

Criteria

Pipe Bursting - 5 and 6, 8" to 18", AC/CI/DI, Few Service Connections

Services

Service Name	N/A	Score 0	Score 1	Score 2	Score 3	Score 4	Score 5	End of Life
BDSWSCS	☐	☐	☐	☐	☐	☐	☑	☑

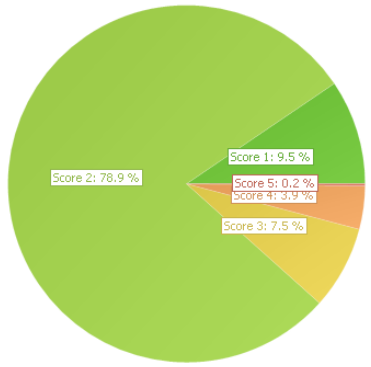
Treatment Filters

Service Name	N/A (UNK)	Score 0	Score 1 (Lined)	Score 2	Score 3	Score 4	Score 5	End of Life
Lining	☑	☑	☑	☑	☑	☑	☑	☑
Material	☐	☑	☑	☑	☐	☐	☐	☐
Diameter	☐	☐	☐	☑	☑	☐	☐	☐
Work Order His...	☑	☑	☑	☑	☑	☑	☑	☑
Velocity Issues	☑	☑	☑	☑	☑	☑	☑	☑
Pressure Issues	☑	☑	☑	☑	☑	☑	☑	☑
Service Connec...	☐	☑	☐	☑	☑	☑	☑	☑

Score Distribution - Pie Chart

Service : OCI (Service Index)

Network Measure | Asset Quantity



Getting Started

1. Plan
2. Implement a GIS platform
3. Select schema
4. Import existing inventory (if you have it)
5. Collect new data
6. Assess condition and develop attributes
7. Combine with web services

Enhancing Existing

- Custom Tools
- Asset Management Plan
- Go Enterprise
- Consider new mobile technology available
- Social Media for Customer Engagement
- GIS-based CMMS
- Develop H&H Model
- Integrate with other systems
- Use GIS for long-range planning

What is ahead for GIS?

TECHNOLOGIES TO WATCH

- AR/VR
- AI
- IoT
- Developments in 3D
- Indoor
- UAV Sensors/Response